



# Clear-Sky Detection Results Inter-comparison

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## Preview



- Clear-sky test algorithms are compared using bias and variance of obs-calc for 6/14/02 First Light granules.
- Accuracy is scene depend. No single algorithm succeeds robustly -- with the following observation:
  - For night ocean, the  $2616\text{ cm}^{-1}$  SST test gives the smallest bias and standard deviation, +/-0.2K and 0.5K.
  - Tobin's flag gives the highest yields and results in +/- 0.5K and 0.5K sdev over the Mediterranean but the bias and sdev increase to -1.0K and 1.2K over the Tropical Pacific.
  - Mitch's SST regression and Larry's spatial coherence test works relatively well for both day and night over the ocean.
  - During the day Vis/Nir clear flag gives the highest yield and less -0.5K bias but 1K standard deviation.



## Clear tests



**Tobin -  $T_b(10-12\mu\text{m})$  threshold + spatial coherence ( $2616\text{ cm}^{-1}$ )**

**HHA - Spatial coherence**

**Mitch - SST threshold (Predicted SST( $918, 965, 1228, 1237\text{ cm}^{-1}$ ) -  $\text{SST}_{\text{AVN}}$ ,  
threshold value:  $[-7.75, -6.75]$ )**

**JPL - SST threshold**

**Night  $4\mu\text{m}$  SST threshold (channel:  $2616\text{ cm}^{-1}$ , threshold:  $[-0.25, 0.25]$ )**

**Day  $11\mu\text{m}$  SST threshold (channels:  $900, 1250\text{ cm}^{-1}$  threshold:  $[1.0, 2.5]$ )**

**Barnet - Based on cloud clearing and cloud fraction retrieval of the final retrieval.**

**Larry - Spatial coherence (looks for transition from warm & smooth(clear)  
to cold & nonuniform(cloudy) area)**

**Vis/Nir - Day (CldFrac=0.0 for AIRS footprint)**



# Cloud Detection Algorithm Summary



- Split Window
  - surface temperature and emissivity and 2 or more channels (e.g. 9 and 11  $\mu\text{m}$ ) with differing atmospheric transmissions
- Scene Heterogeneity
  - standard deviation of radiances in adjacent footprints (3x3's)
  - heterogeneity in scene is indicative of clouds
- Cloud Signature
  - difference of surface channel radiances at separated frequencies
  - cirrus and water clouds have spectral signatures
- Clear Scene Radiance Prediction
  - surface channel radiance differenced with prediction
  - uses correlative data, e.g. analysis, forecast, radiosonde...



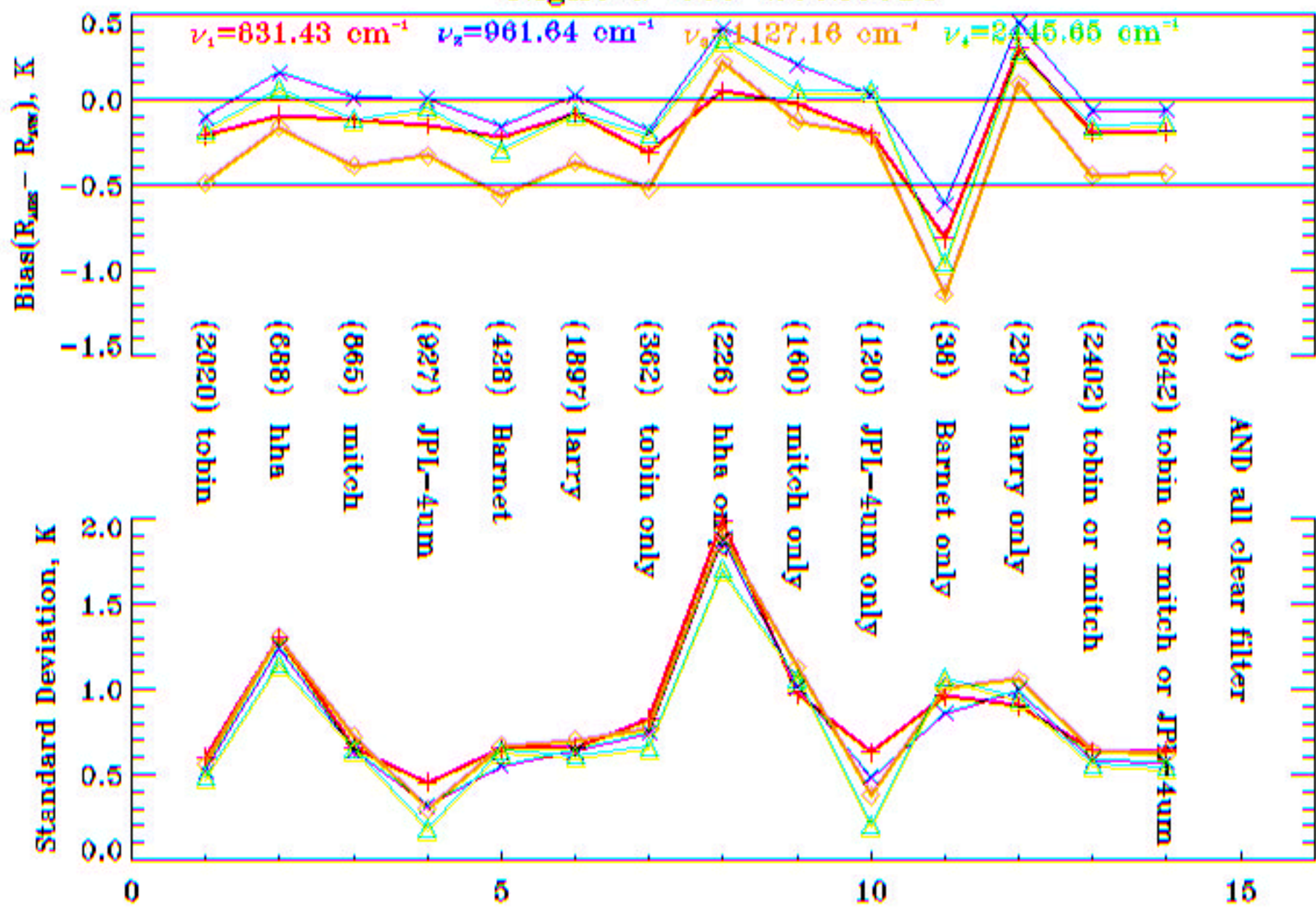
## Cloud Detection Algorithm Summary (cont.)



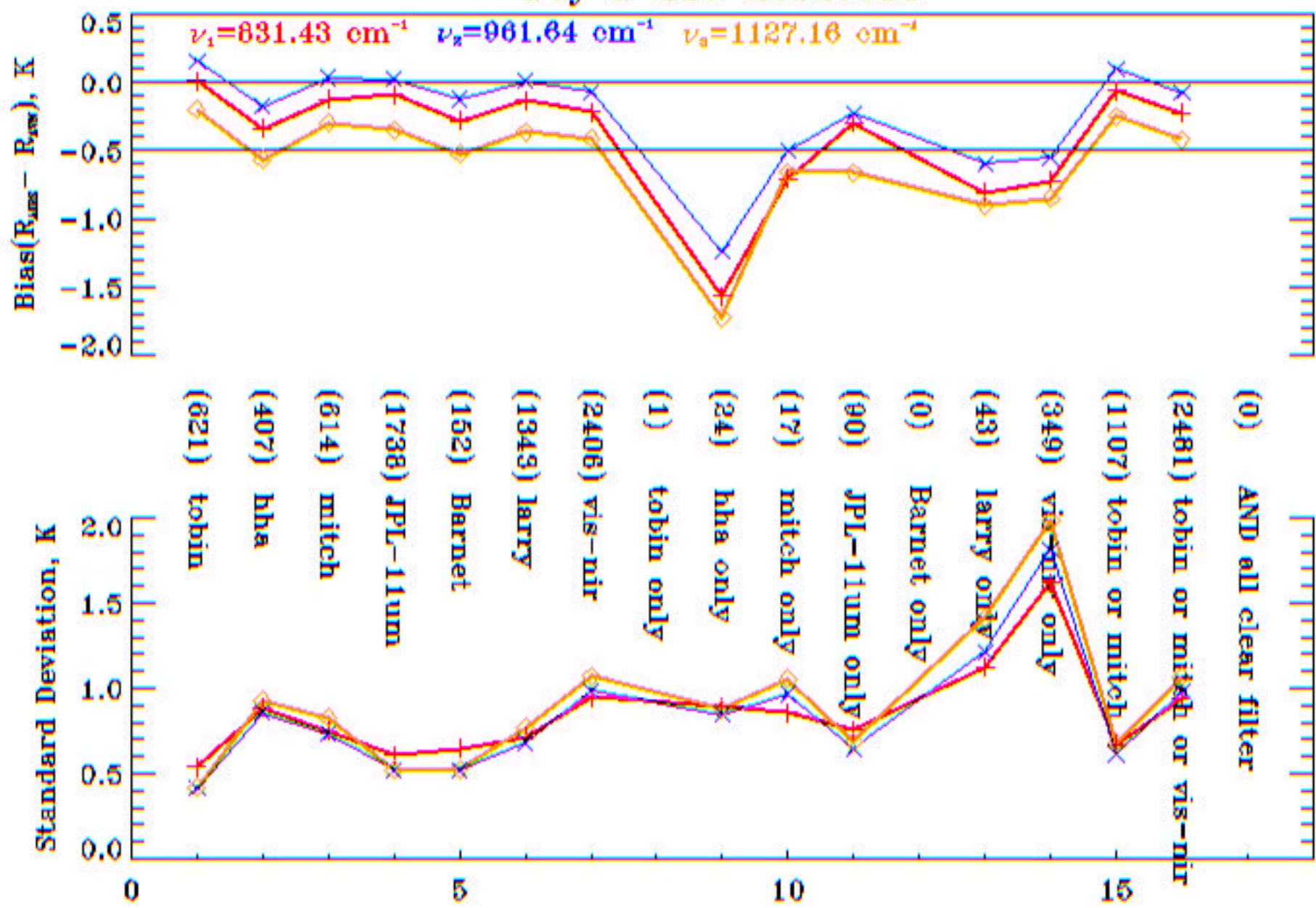
- Methods incorporated in prototype algorithms

	Split Window	Hetero- geneity	Cloud Signature	Radiance Prediction
GSFC	Cloud Clearing Noise Amplification			
JPL	X	X		
NOAA-LM	?	X	?	
NOAA-MG	X	X		X
SSEC	X	X	X	?

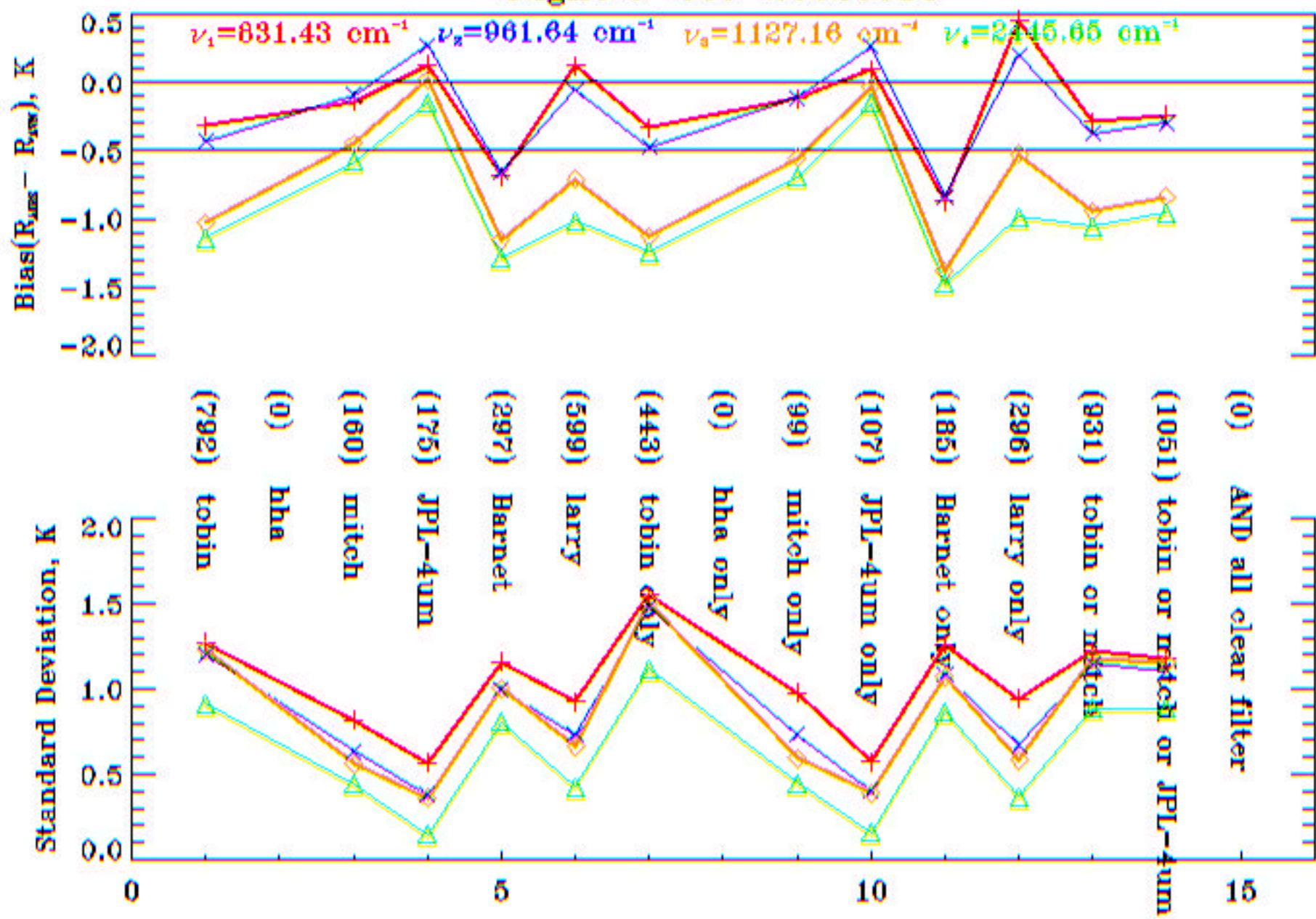
# Night G-005-20020614



# Day G-115-20020614



# Night G-089-20020614





## Conclusions



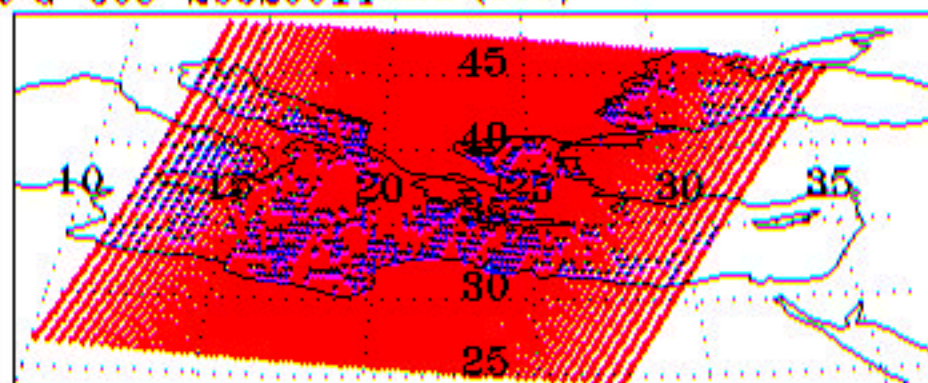
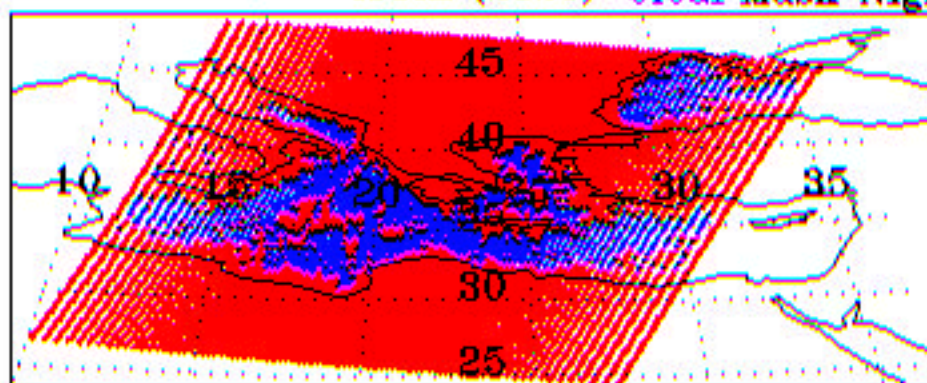
- Radiances predicted from NCEP forecast were used to assess accuracy.
- Accuracy appears scene dependent, no one prototype is superior.
- Different prototypes use different combinations of channels
- Prototypes are based on past experience and do not exploit AIRS hyper-spectral capabilities
- Incorporate more channels, especially in cloud signature approaches.



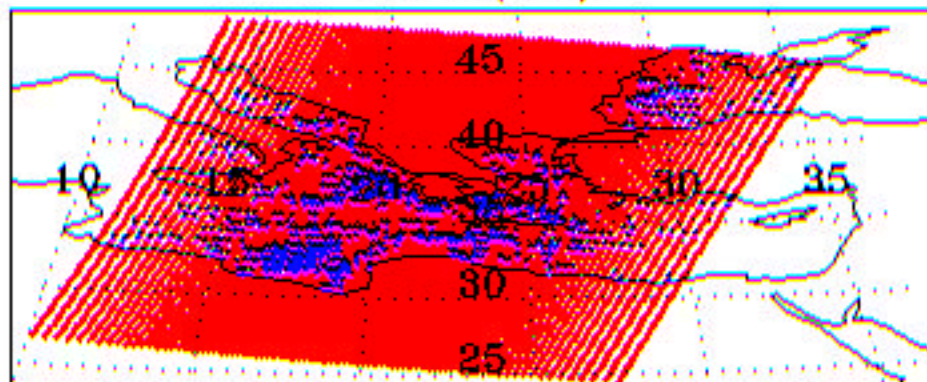
## Intermediate Plans

- Repeat the comparison for 7/20/02 focus granules.
- Investigate the possibility of combining different algorithms, resulting in an accurate and robust clear-sky detection scheme.
- Explore cloud spectral signature and utilize high spectral information of AIRS data in cloud detection algorithms.

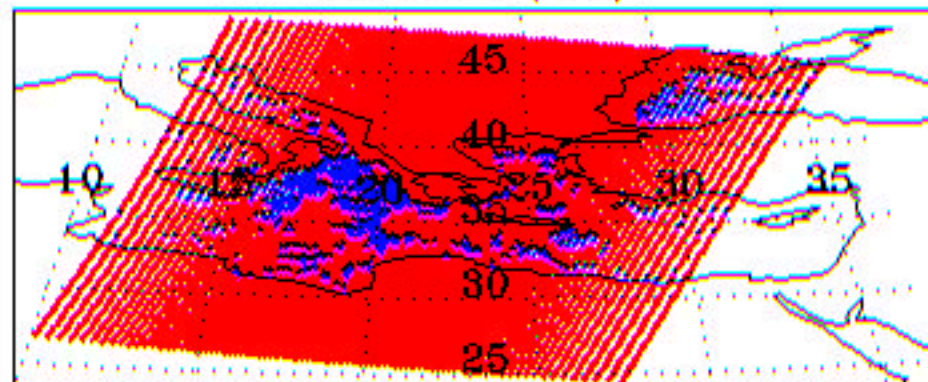
tobin (2020) Clear Mask Night G-005-20020614hha (688)



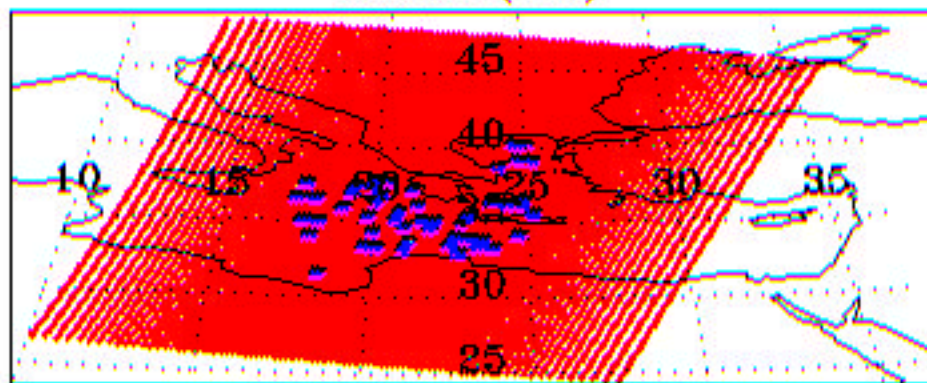
mitch (865)



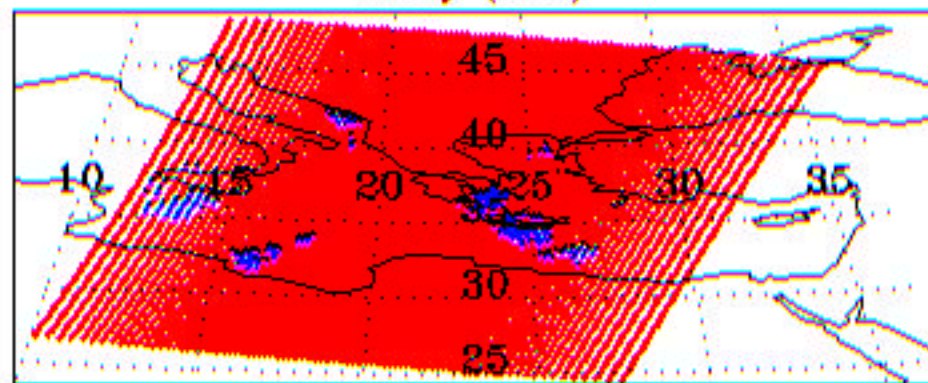
JPL-4um (927)



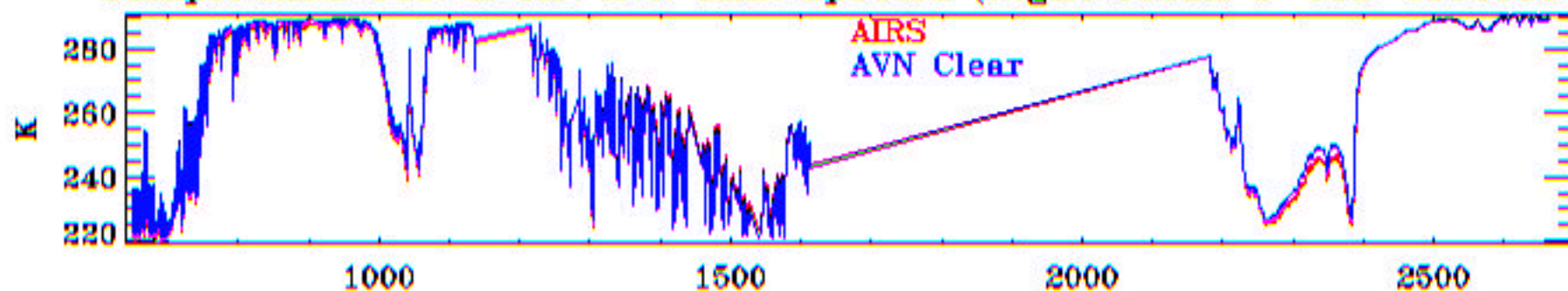
Barnet (428)



larry (277)



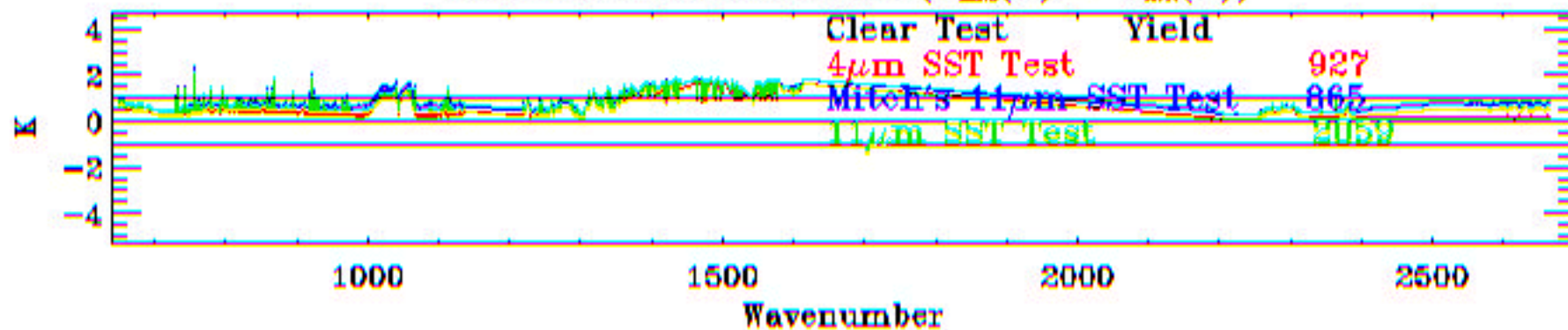
Sample AIRS Obs. & Clr. AVN Sim. Spectra (Night Ocean G-005-20020614)



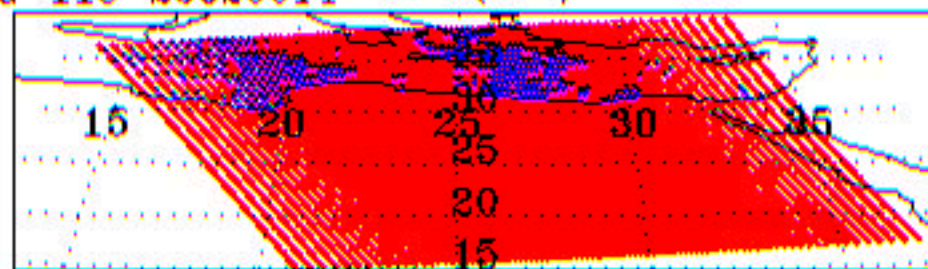
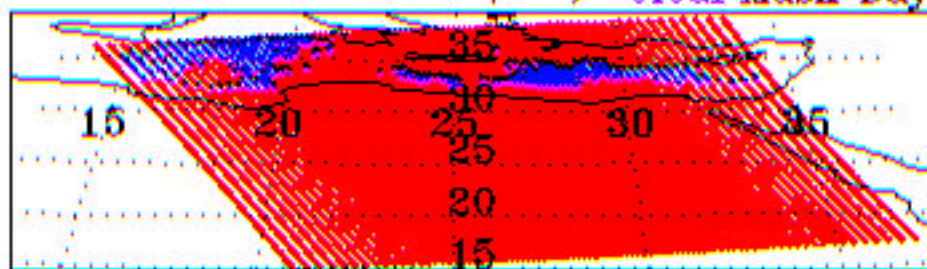
Bias ( $B_{\text{AIRS}}(T) - B_{\text{AVN}}(T)$ )



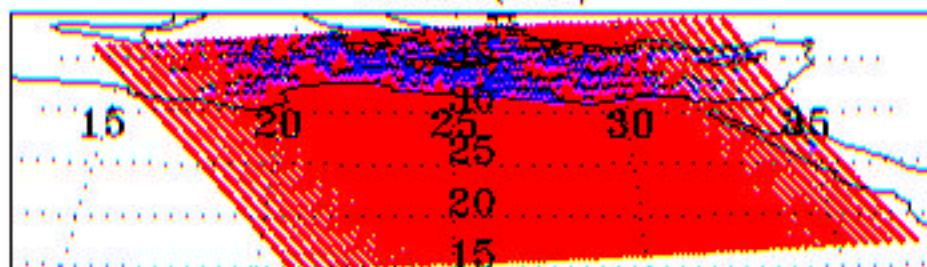
Standard Deviation of ( $B_{\text{AIRS}}(T) - B_{\text{AVN}}(T)$ )



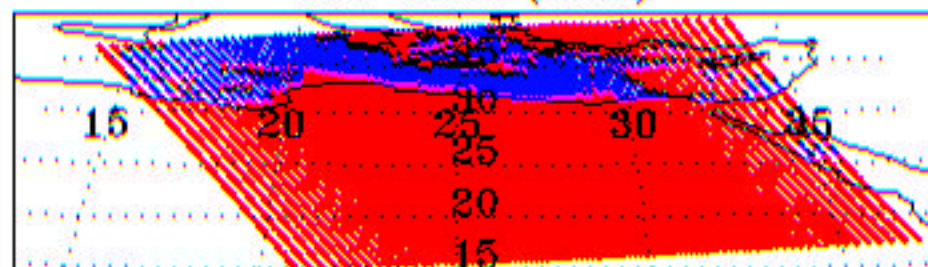
tobin (621) Clear Mask Day G-115-20020614 hha (407)



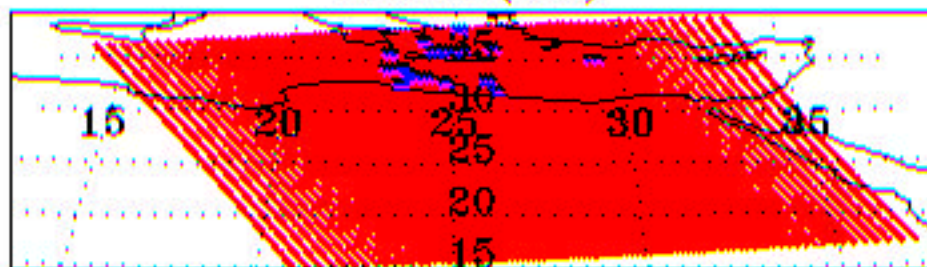
mitch (614)



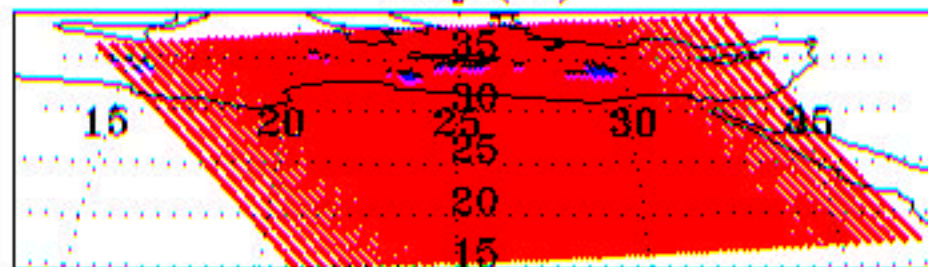
JPL-11um (1738)



Barnet (152)



larry (78)



vis-nir (2406)

